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Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended to overcome Examiners rejections as required by Examiner.

No new matter has been added.

Claim Rejections under 35 USC 112

1. Claims 13-15, 19, and 21-25 stand rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement. Examiner alleges that the claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors, at the time the application was filed, has possession of the claimed invention.

Examiner alleges that in claim 13, line 7, "without photoresist present" is new matter. Examiner has failed to point out why and how one of ordinary skill would understand a tungsten

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etchback planarization process to not be understood by one of ordinary skill as being performed without photoresist present as is clearly shown by Applicants in Figures 2B and 2C.

Applicants further respectfully point out that the limitation seemed a necessary qualifier to define over Examiner overly broad interpretation of the claims as Examiner previously applied two primary references **related to photoresist patterned etching processes and cleaning solutions to remove photoresist residue.**

"[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the **inferences which one skilled in the art would reasonably be expected to draw therefrom.**" *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968)

The fundamental factual inquiry is whether the **specification conveys with reasonable clarity to those skilled in the art that, as of the filing date sought, applicant was in possession of the invention as now claimed.** See, e.g., *Vas-Cath, Inc.*, 935 F.2d at 1563-64, 19 USPQ2d at 1117.

An adequate written description of the invention may be shown by any description of sufficient, relevant, identifying characteristics so long as a person skilled in the art would recognize that the inventor had possession of the claimed invention. See, e.g., *Purdue Pharma L.P. v. Faulding Inc.*, 230

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F.3d 1320, 1323, 56 USPQ2d 1481, 1483 (Fed. Cir. 2000).

Thus, it is clear that one of ordinary skill would appreciate that a tungsten etchback planarization process is carried out without photoresist present, either explicitly as shown by Applicants in the Figures, or as a clear inference.

Examiner has also not supported any assertion that such language constitutes new matter.

"Mere rephrasing of a passage does not constitute new matter. Accordingly, a rewording of a passage where the same meaning remains intact is permissible", *In re Anderson*, 471 F.2d 1237, 176 USPQ 331 (CCPA 1973).

"In order to satisfy the written description requirement, the disclosure as originally filed does not have to provide *in haec verba* support for the claimed subject matter", *Purdue Pharma L.P. v. Faulding Inc*, 230 F.3d 1320, 56 USPQ2d 1481 (Fed. Cir. 2000).

Thus, Examiner has failed to make out a *prima facie* case that Applicants language in claim 13 "without photoresist

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present" violates the written description requirement or constitutes new matter. See MPEP 2163.04(I):

In rejecting a claim, the examiner must set forth express findings of fact which support the lack of written description conclusion (see MPEP § 2163 for examination guidelines pertaining to the written description requirement). These findings should:

(A) Identify the claim limitation at issue; and

(B) Establish a *prima facie* case by providing reasons why a person skilled in the art at the time the application was filed would not have recognized that the inventor was in possession of the invention as claimed in view of the disclosure of the application as filed.

Nevertheless, in an effort to further prosecution on the merits, Applicants have removed the offending language.

With respect to claim 21, Examiner further asserts that the term "alkanolamine" is new matter, even though Applicants have specifically pointed out support in the Specification in the previous office action and re-produce again paragraph 0032 of the Specification:

"Such oxidant solution includes about 4.56~8.05, and preferably, about 7.17 wt. % catechol; about 5.13~8.21, and preferably, about 6.93 wt. % diglycolamine; about 1.63~2.58, and preferably, about 2.21 wt. % gallic acid; about 11.70~13.44, and preferably, about 12.06 wt. % hydroxylamine; about 24.76~27.50, and preferably, about 26.03 wt. % moisture; about 22.46~27.94,

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and preferably, about 25.36 wt. % monoethanolamine; and about 18.98~23.02, and preferably, about 21.12 wt. % monoisopropanolamine."

Thus, Applicants have explicitly disclosed two representative alkanolamines (monoethanolamine and monoisopropanolamine) comprising an oxidant solution.

Examiner argues that the disclosure does not support such "a broad meaning" but cites no support for such an argument as supporting a claim of new matter.

("[W]here no explicit description of a generic invention is to be found in the specification * * * mention of representative compounds may provide an implicit description upon which to base generic claim language.",
In re Robins, 429 F.2d 452, 456-57,
166 USPQ 552, 555 (CCPA 1970)

As long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement of 35 U.S.C. 112 is satisfied. *In re Fisher*, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970). Failure to disclose other methods by which the claimed invention may be made does not render a claim invalid under 35 U.S.C. 112. *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1533, 3 USPQ2d 1737, 1743 (Fed. Cir.), cert. denied, 484 U.S. 954 (1987).

Thus, Examiner has failed make out a *prima facie* case of

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violation of the written description requirement or that Applicants claim language constitutes new matter with respect to the language "without photoresist present" in claim 13 and "alkanolamine" in claims 21 and 24.

Nevertheless, in an effort to further examination on the merits Applicants have amended claims 13 to remove the offending language "without photoresist present", since carrying out a tungsten etchback process is implicitly understood to be carried out without photoresist, by one of ordinary skill in the art, as Examiners newly cited references make clear.

In further effort to further examination on the merits, Applicants have further amended claims 21 and 24 to recite the particular disclosed alkanolamines.

Applicants have further amended mended claim 23 to correct a spelling error to recite "diglycolamine", as disclosed.

Claim Rejections under 35 USC 103

2. Claims 1, 2, 5, 9, 10, 12-14, 17, and 21-25 stand rejected under 35 USC 103(a) as being unpatentable over Lee et

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al. (US20030228990) in view of admitted prior art , above, as evidenced by alleged admitted prior art as evidenced by Chou (US 6,235,644), Shinohara (US 6,355,553), and Kadomura (US 5,227,337).

Examiner states that Chou, Shinohara, and Kadomura are not relied upon (see paragraph 5 of Office action) in rejection but only to support a statement that Applicants disclosed tungsten etchback process is "well-known".

Lee et al., discloses "A residue remover **for removing polymeric material and etch residue** (see Abstract, paragraph 0056) that includes 2-(2-aminoethylamino)-ethanol (AEEA) (see paragraph 0067) and optionally another two-carbon atom linkage alkanolamine compound, gallic acid or catechol, water, a polar organic solvent, and **hydroxylamine**. Lee et al. teach that the solution may be used for removing **photoresist** or other residue from a substrate, such as an integrated circuit semiconductor wafer including **titanium metallurgy**"... "**without attacking titanium or other metallurgy** on the substrate". (see Abstract; paragraphs 0057-0058;

Nowhere do Lee et al. **disclose a metal planarization**

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including an etchback process or oxidized metal residues or an oxidant solution for removing oxidized metal residues.

Note that Applicants disclose that a commercially available oxidizer solution may be used in Applicants process (see paragraph 0036).

Examiner argues that Applicants alleged admitted prior art is relied on "only to show the well-known tungsten etch-back process" where Applicants recognize the problem of tungsten residues to be removed following a tungsten planarization process at paragraph 009:

"The most common method for removing the tungsten residues 24 from the tungsten plug structure 9 is the wet scrubbing method, in which a jet of high-pressure deionized water sprayed against the structure 9. In addition, a scrubber brush may be simultaneously applied against the structure 9. The water jet is normally sprayed at a pressure of about 2,000-3,000 psi. It has been found, however, that the wet scrubber method is ineffective in completely removing the tungsten residues from the tungsten plug structure prior to deposit of the top metal layer on the top dielectric layer and tungsten plugs. While an in-situ post-etch bake process may be used immediately after the tungsten etchback process to prevent formation of the residues, this post-etch bake fails to remove the residues after they have formed. Accordingly, a new and

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improved process for the removal of tungsten residues from a tungsten plug or other structure is needed."

Chou discloses a three step tungsten etchback process where a first etchback step is carried out and a second over etch process is then carried out to remove metal residue remaining, followed by a gas flush and then followed by a second overetching process (see e.g., Abstract; claim 1). Nowhere does Chou recognize or suggest a solution to the problem of metal etching residues on the plug **following the etchback process**.

Shinohara discloses a method for a two-step etchback process where a smoothing layer is formed on a tungsten layer prior to the main planarization etchback process which is then followed by a second etch process where the deposition and etching rates of the first and second film are about equal to form a smooth surface on a tungsten plug (see Abstract; claim 1). Nowhere does Shinohara recognize or suggest a solution to the problem of metal etching residues on the plug **following the etchback process**.

Kadomura discloses a two-step etchback process where the first (main) etchback process removes about 90% of the tungsten at a first temperature and the second etchback process carried

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out at a second lower temperature to lower the etch rate (see Abstract; claim 1). Nowhere does Chou recognize or suggest a solution to the problem of metal etching residues on the plug **following the etchback process.**

Thus, the fact that a **tungsten (metal) etchback process** (planarization process) to form a tungsten (metal) is **well known**, as Examiner alleges, does not help Examiner in producing a **prima facie** case of obviousness.

Lee et al. does not disclose Applicants etchback process and none of the references recognizes or suggests a solution to the problem that Applicants have recognized and solved; removing **removing oxidized metal residues from a metal plug following a metal etchback process.** Moreover, Lee et al. specifically teach away from Applicants invention by teaching that the cleaning solution of Lee et al. (**for removing polymeric residues**) is for **preventing attack on metallurgy (e.g., Ti and Al).**

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior

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art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

3. Claims 3, 7, 11 and 14 stand rejected under 35 USC 103(a) as being unpatentable over Lee et al. in view of Applicants alleged admitted prior art, above, in further view of Wolf (Silicon processing, Vol. 1, page 51) or Verhaverbeke (US 5,972,123).

Applicants reiterate the comments made above with respect to Lee et al.

The fact that Wolf or Verhaverbeke disclose that applying a

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solution for wet etching or cleaning can include a spraying method does not further help Examiner in establishing a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) **must teach or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Conclusion

The cited references, either singly or in combination, do not produce Applicants disclosed and claimed invention, and therefore fail to make out a *prima facie* case of obviousness with respect to both Applicants independent and dependent claims.

The Claims have been amended to overcome Examiner rejections. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that

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the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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